Committee on Planetary Protection (CoPP)

Status report to the Space Studies Board 15 November, 2022

Joseph Alexander and Amanda Hendrix, Co-Chairs

Committee on Planetary Protection

- Established in July 2020 as a new standing committee of the SSB and Board on Life Sciences.
- 12 current members with expertise in relevant science, engineering, project management, and policy. Members very engaged in the committee's first three studies. Will add to membership after next study is chosen.
- After completing 3 reports in 2 years NASA is giving us a breather during which we are focusing on the committee's oversight role. Expect a new study request in 2023.
- CoPP-COSPAR Planetary Protection Panel relationship couples US priorities to the international community.

Committee Membership

- Joseph K. Alexander, Independent Consultant, Robert E. Lindberg, Jr., Independent Co-Chair
- Amanda R. Hendrix, Planetary Science Institute, Co-Chair
- Angel Abbud-Madrid, Colorado School of Mines
- Anthony Colaprete, NASA Ames Research Center
- Michael J. Daly, Uniformed Services University of the Health Sciences
- David P. Fidler, Council on Foreign Relations
- Sarah A. Gavit, Jet Propulsion Laboratory*
- Andrew D. Horchler, Astrobotic Technology, Inc.
- Eugene H. Levy, Rice University

- Consultant
- Margarita M. Marinova, Independent Consultant
- Deanne Rogers, Stony Brook University, The State University of New York*
- Gerhard H. Schwehm, European Space Agency (retired)
- Trista J. Vick Majors, Michigan Technological University
- (* Member retiring, October 2022)

Staff

- Daniel Nagasawa, Study Director, SSB
- Nancy Connell, Senior Scientist, BLS
- Colleen Hartman, Board Director
- Megan Chamberlain, Program Assistant



NATIONAL ACADEMIES Sciences Engineering Medicine

Planetary Protection Considerations for Missions to Small Bodies in the Solar System

Committee on Planetary Protection Space Studies Board

In Collaboration with Aeronautics and Space Engineering Board and Board of Life Sciences



NASA BRIEFING - 8 SEPTEMBER 2022

Statement of Task

https://www.nationalacademies.org/our-work/committee-on-planetary-protection

- Are there particular populations of small bodies for which contamination of one object in the population would not be likely to have a tangible effect on the opportunities for scientific investigation using other objects in the population?
- If such populations exist, would it be suitable to categorize future missions to those bodies as Category I?



Approach

The Committee considered the following groups of small solar system bodies (SBs): *(initially grouped by dynamical/orbital characteristics)*

- Main Belt Asteroids,
- Near Earth Objects,
- Trojan asteroids,
- Comets & Centaurs, and
- Kuiper Belt Objects.

For each SB group, the Committee then considered the following criteria for categorization:

- Size of population,
- Status of knowledge,
- Likelihood of revisiting,
- Geological activity and resurfacing,
- Size of target body, and
- Composition.

The Committee focused on a compositional perspective:

- what is known from mission visits/flybys, meteorites & sample studies and
- what these bodies might reveal about solar system formation and evolution.

Principal Conclusion

Given the importance of some classes of relatively primitive, volatile-rich, and organic-bearing small bodies to studies of prebiotic chemistry, and the sparsity of current knowledge about them, **the Committee sees no reason to reduce the current categorizations (from Category II to Category I)** for missions to such objects until such time as scientific knowledge changes.

On the other hand, Category I is appropriate for missions to rocky, metamorphosed, near-Earth objects and main-belt asteroids.







• Ceres is a special case.

1 Ceres

- Ceres is clearly different from other SBs.
 - Ceres is not a "small body," it's a dwarf planet.
- Ceres presents a valuable case study because the Dawn mission at Ceres revealed it to be unique and perhaps astrobiologically important (despite being rather bland from telescopic observations)
 - \circ Could other SBs be special too?



Category I vs. Category II

- Category I missions carry no planetary protection requirements at all.
- Category II missions require only relatively routine information about the mission. This includes
 - documenting the intended target body,
 - the mission intent (fly-by, landing, or impact),
 - the planned trajectory,
 - the post launch trajectory status,
 - and the final disposition of the spacecraft.
 - no sterilization requirements!!

Finding 6: Per current NASA and COSPAR planetary protection guidelines, Category II missions require <u>only a minimal level</u> of documented information, primarily target and impact/landing site.



Need for an Archive

- It is important that the scientific community is aware of which bodies have been visited by any mission, especially if they have been landed on or crashed into (in case the target is revisited).
 - Whether a target will ever be revisited is not known prior to visiting it initially.

Finding 7: Access to information prepared in response to planetary protection requirements is important for planning future missions to certain small bodies to study chemical evolution and the origin of life. The committee was **unable to confirm that an archive of planetary protection information currently exists**.



The Regulatory Gap

- Problems persist with whether and how U.S. federal law regulates non-government, private-sector space activities for planetary protection purposes.
 - The Committee's discussions with OSTP, FAA, NASA, & Hill staff representatives reveal no recent progress towards a solution.
 - Conundrum: The implicit intent of the Small Bodies SoT is on private sector missions, and yet NASA regulations don't apply to the private sector.
 - The Committee also learned that coordination between private companies and the PPO was voluntary.
 - And standards are considered voluntary by the FAA.

Finding 8. The application of planetary protection policies to private sector space activities targeting small solar system bodies remains compromised by (1) misperceptions in the private sector about planetary protection requirements; and (2) **confusion about the U.S. government's ability to apply and enforce planetary protection policies concerning non-governmental space activities**.



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